

## CLAIMS

1. An arrangement, for allowing compensation of lost, discarded or unsent traffic on the downlink in a communication system supporting communication of packet data and classification of mobile traffic allowing application of different charging schemes for different types of traffic

c h a r a c t e r i z e d i n

that it comprises a packet data node (PDN, G-PDN; GGSN; SGSN, CGSN) handling classification of traffic into different types, e.g. service class, and for applying an appropriate charging scheme depending on type, that said node provides (labels) and sends information relating to at least type, e.g. service class, to subsequent nodes (PDN, SGSN; RNC; BSC) on the downlink to a mobile station and in that a subsequent node (PDN; SGSN; RNC; BSC) detecting a packet loss, notes said loss and enables use of the information of said loss together with at least type information to enable for correction of charging due to traffic loss.

2. An arrangement according to claim 1,

c h a r a c t e r i z e d i n

that correction/compensation for lost traffic is performed at regular or predetermined occasions, e.g. time or volume based, that loss reports are provided from radio nodes (BSC;RNC) to a preceding packet data node, said loss reports including at least said type information for said discarded/lost data traffic, e.g. service class information and in that said packet data nodes e.g. includes said type information in a new field in a Call Detail Record or similar.

3. An arrangement according to claim 1,

c h a r a c t e r i z e d i n

that charging correction/compensation for lost traffic is performed in real time and in that loss reports are provided from radio nodes (BSC;RNC) to a preceding packet data node substantially immediately at occurrence of the loss, and in that a loss report at least including type information is provided to the packet data node supporting flexible charging together with subscriber information (IMSI) and access point identification (NASAPI) in a new message, e.g. a new GTP-message.

4. An arrangement according to claim 1, 2 or 3, characterized in that the packet data node comprises a packet data node (G-PDN; GGSN; CGSN) with a gateway functionality, e.g. a GGSN.
5. An arrangement according to claim 1, 2 or 3, characterized in that the packet data node comprises a serving packet data node, e.g. a SGSN.
6. An arrangement according to any one of claims 1-5, characterized in that the packet data node comprises a packet data serving functionality and a gateway functionality, e.g. a CGSN.
7. An arrangement according to any one of the preceding claims, characterized in that said packet data node handling classification and labeling provides traffical packets with information, e.g. labels traffical packets with service class information and rating information.
8. An arrangement according to any one of claims 1-6, characterized in

that said packet data node handling classification and labeling provides traffical packets with information, e.g. labels traffical packets, with service class information and a time stamp.

- 5     9.    An arrangement according to claim 7 or 8,  
c h a r a c t e r i z e d i n  
that the traffical packets are provided with chain identification  
information.
- 10    10.   An arrangement according to any one of the preceding claims,  
c h a r a c t e r i z e d i n  
that the packet data node is an access node in a GSM/GPRS system  
in communication with BSC:s.
- 15    11.   An arrangement according to any one of claims 1-9,  
c h a r a c t e r i z e d i n  
that the packet data is an access node supporting a UMTS/GPRS  
system and supports communication with RNC:s.
- 20    12.   An arrangement according to claim 10 and 11,  
c h a r a c t e r i z e d i n  
that the packet data node is a dual access node supporting  
communication with BSC:s as well as RNC:s.
- 25    13.   An arrangement at least according to claim 2,  
c h a r a c t e r i z e d i n  
that loss reports relating to discarded traffic are sent  
periodically or at given times.
- 30    14.   An arrangement at least according to claim 2,  
c h a r a c t e r i z e d i n

that loss reports relating to discarded traffic are sent based on the volume of the discarded traffic, e.g. of given types or service classes.

5 15. An arrangement at least according to claim 3,  
c h a r a c t e r i z e d i n  
that loss reports relating to discarded traffic are provided/sent  
in real time, substantially instantly at the occurrence of a loss  
directly or indirectly to the node handling flexible charging.

10 16. An arrangement according to any one of the preceding claims,  
c h a r a c t e r i z e d i n  
that the classification and charging scheme application handling  
is performed by a gateway packet data node and in that it supports  
15 a content based charging functionality e.g. Flexible Bearer  
Charging, FBC or IP flow based bearer level charging.

17. An arrangement according to claim 16,  
c h a r a c t e r i z e d i n  
20 that information at least relating to type, e.g. service class is  
provided to a packet data node with a serving functionality, e.g.  
SGSN, and in that said node forwards such information to  
subsequent nodes, and in that if for communication between the  
serving packet data node and a subsequent node a different  
25 protocol is used than the protocol used between the serving node  
and the gateway packet data node, a conversion is performed such  
that the information can be sent over said other protocol.

18. An arrangement according to claim 17,  
30 c h a r a c t e r i z e d i n  
that the serving packet data node is a SGSN, that the gateway  
packet data node is a GGSN and in that the information relating to  
at least type is added to the GTP header of the downlink payload

to SGSN, if relevant to RNC:s, whereas if it is to be forwarded to BSC:s, the information is included in the BSSGP header.

19. An arrangement at least according to claim 3,

5 c h a r a c t e r i z e d i n

that for an RNC having discarded traffic, a loss report comprising a RANAP Data Volume Report is sent substantially instantaneously at occurrence of the loss of data to the preceding packet data node uplinks and in that, unless such preceding node handles flexible charging, it sends the new loss report message with IMSI, NASAPI to the node handling such functionality.

20. An arrangement at least according to claim 3,

c h a r a c t e r i z e d i n

15 that for a BSC having discarded traffic, a loss report including at least service class information, rating information or a time stamp, is sent substantially instantaneously at occurrence of the loss to the preceding packet data node uplinks for charging correction/compensation, and in that said packet data node unless itself handles the flexible charging functionality, provides the new loss report message with IMSI, NSAPI to the node handling such functionality.

21. An arrangement according to any one of the preceding claims,

25 c h a r a c t e r i z e d i n

that the subsequent nodes register information about discarded packets, e.g. at least type and amount.

22. A packet data node in a communications system supporting communication of packet data handling classification and/or application of charging depending on type of or characteristic of traffic

30 c h a r a c t e r i z e d i n

that it comprises means for sending information about at least type, e.g. service class, of data packets sent on the downlink to subsequent nodes and that such subsequent node sends reports relating to discarded/lost traffical packets with at least type  
5 information to said packet data node allowing said packet data node to modify charging to compensate for lost data packets, unless said packet data node itself supports the flexible charging functionality.

10 23. A packet data node according to claim 22,  
c h a r a c t e r i z e d i n  
that it comprises a serving packet data support node (SGSN), a gateway packet data support node (GGSN) or a combined gateway and serving packet data support node (CGSN).

15 24. A packet data support node according to claim 22 or 23,  
c h a r a c t e r i z e d i n  
that it forwards service class information (QoS), rating information or time stamp information for sent packets and  
20 optionally chain information (chain id) to subsequent nodes.

25 25. A packet data support node according to any one of claims 22-24,  
c h a r a c t e r i z e d i n  
that it supports real time compensation/correction for lost packets and in that loss reports are provided in real time including e.g. IMSI, NSAPI.

30 26. A method for allowing charging correction or compensation for lost discarded or unsent data packets on the downlink towards a mobile station in a system supporting content based charging or flexible bearer charging,  
c h a r a c t e r i z e d i n

that it comprises the steps of:

- sending information at least relating to assigned charging scheme, e.g. service class, to subsequent nodes (SGSN; RNC; BSC) from a node handling classification of packets and/or flexible/content based charging;
- sending a report from such a subsequent node towards the node handling classification and/or application of flexible/content based charging from a node discarding an IP packet unless itself supports flexible/content based charging.

27. A method according to claim 26,

c h a r a c t e r i z e d i n

that the step of sending information downlinks comprises sending of service class, rating information or providing a time stamp for a packet, and optionally information for identifying the chain an IP packet belongs to.

28. A method according to claim 26 or 27,

c h a r a c t e r i z e d i n

that the reporting step comprises:

- sending a report including subscriber id (IMSI), access point id (NSAPI) substantially instantaneously from a node detecting that a packet is discarded to allow for real time compensation/correction, and in that such node further
- registers discarded packet type and amount of discarded packets.

29. A method according to any one of claims 26-28,

c h a r a c t e r i z e d i n

that the reporting step comprises:

- introducing the reporting information in a packet sent over the relevant protocol between nodes up to the node handling classification/content based (flexible) charging.

5 30. A method according to any one of claims 26-29,  
c h a r a c t e r i z e d i n  
that the node handling classification/charging comprises a gateway  
packet data node (GGSN), a serving packet data node (SGSN) or a  
combined gateway and serving packet data node (CGSN).  
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31. A method according to claim 26,  
c h a r a c t e r i z e d i n  
that reporting is performed based on volume, with given time  
intervals or at given points in time, e.g. supporting CDR-based  
15 charging.

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